



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/079,775	02/19/2002	Marina V. Plat	D900D/1368D	9123

7590 05/10/2004

Kelly K. Korzik
Winstead, Sechrest & Minick P.C.
P.O. Box 50784
1201 Main Street
Dallas, TX 75250-0784

EXAMINER

LEE, HSIEN MING

ART UNIT	PAPER NUMBER
----------	--------------

2823

DATE MAILED: 05/10/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/079,775	Applicant(s) PLAT ET AL.	
	Examiner Hsien-Ming Lee	Art Unit 2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).

Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on 26 February 2004.

2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) 1-6 and 13-18 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5) ☒ Claim(s) 13-17 is/are allowed.

6) ☒ Claim(s) 1-6 and 18 is/are rejected.

7) ☐ Claim(s) _____ is/are objected to.

8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9) ☐ The specification is objected to by the Examiner.

10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a) ☐ All b) ☐ Some * c) ☐ None of:

1. ☐ Certified copies of the priority documents have been received.

2. ☐ Certified copies of the priority documents have been received in Application No. _____.

3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Remarks

1. Claims 1-6, 13-18 are pending in the application, wherein claim 18 is newly added.
2. The previous non-final Office Action is withdrawn.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 1-4, 6 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chung et al. (US 6,184,142) in view of Huang et al. (US 6,159,661).

In re claims 1-3 and 6, Chung et al., in Figs. 6A-6F and related text, teach the claimed method providing a semiconductor device, the semiconductor including a first layer 113/116/112 desired to be etched, the method comprising the steps of:

- (a) providing, by depositing, an antireflective coating (ARC) layer 114 (Fig. 6A), which is a SiON having antireflective properties (col. 4, lines 30-32);
- (b) patterning a first resist layer 130, the first resist layer 130 including a pattern having a plurality of apertures therein for etching a first portion (i.e. the portion where a dual damascene opening to be formed) of the first layer 113/116/112 (Fig. 6A);
- (c) etching the first portion of the first layer 113/116/112 to form a via (Figs. 6C);
- (d) removing the first resist layer 130 utilizing a plasma etch with O₂ plasma (Figs. 6A-6B);

Art Unit: 2823

(e) patterning a second resist layer 131, the resist layer 131 including a pattern having a plurality of apertures therein for etching a second portion of the first layer 113/116/112 (Fig.6D); and

(f) etching the second portion of the first layer 113/116/112 to form a trench as shown in Fig. 6F (Figs. 6E-6F).

In re claim 18, Chung et al teach a method for reducing antireflective coating (ARC) layer removal comprising the steps of:

- depositing an ARC layer 114 on a first layer 113/116/112, wherein said ARC layer 114 comprises a layer of SiON having a thickness of about 500~1,000 Angstroms;
- patterning a first resist layer 130 on said ARC layer 114, wherein said first resist layer 130 comprises a pattern having a plurality of apertures therein for etching a first portion of said first layer 113/116/112;
- etching said first portion of said first layer 113/116/112;
- removing said first resist layer 130 utilizing a plasma etch after said first portion of said first layer 113/116/112 is etched;
- patterning a second resist layer 131, wherein the resist layer 131 comprises a pattern having a plurality of apertures therein for etching a second portion of the first layer 113/116/112 (Fig.6D); and
- etching the second portion of the first layer 113/116/112, i.e. forming the opening on the right as shown in Fig. 6F (Figs. 6E-6F).

Chung et al. further teach that the ARC layer has a thickness of between about 500 to 1,000 Angstroms (col. 3, lines 46-52). The thickness range “between about 500 to 1,000 Angstroms”

Art Unit: 2823

allows for thickness slightly less than 500 Angstroms, which obviously teaches the use of a thickness within claimed range "less than about 500 Angstroms." See M.P.E.P. 2144.05

Obviousness of Ranges

Chung et al. further suggest a **desirability** of protecting the low-k dielectric layer from **oxygen-plasma etching damage** during photoresist layer stripping (col. 1, lines 52-67) although Chung et al. is silent as to the ARC layer being resistant to the oxygen plasma etching. For the purpose of protecting the low-k dielectric layer 113, Chung et al. teach forming the ARC layer 114 on the low-k dielectric layer.

Chung et al. do not teach that the ARC layer is 300 Angstroms plus or minus thirty Angstroms (claim 6).

However, Huang et al., in an analogous art, teach forming an ARC layer 34 (i.e. SiON) on a low-k dielectric layer 32a, wherein the ARC layer 34 typically has a thickness of about 300~600 Angstroms (col. 4, lines 24-31). Huang et al. further suggested that using **SiON as the ARC layer** on the low-k dielectric layer would **protect the low-k dielectric from oxygen-plasma etching damage** (col. 2, lines 55-57 and col. 4, lines 26-29), which is coherent with the aforementioned desirability as indicated by Chung et al..

Therefore, it would have been obvious to one of the ordinary skill in the art, at the time the invention was made, to select a desired ARC thickness as taught by Huang et al. in the method of Chung et al., since by this manner it would provide a suitable antireflective property and better resistance to oxygen plasma etching.

In re claim 4, Chung et al. in view of Huang et al. teach removing the resist layer utilizing a plasma etch with a plasma including a forming gas (i.e. O₂) but do not expressly teach that the plasma includes four percent of the forming gas.

However, the selection of the percentage of the forming gas is obvious because it is a matter of determining optimum process condition by routine experimentation with a limited number of species. In re Jones, 162 USPQ 224 (CCPA 1955)(the selection of optimum ranges within prior art general conditions is obvious) and In re Boesch, 205 USPQ 215 (CCPA 1980)(discovery of optimum value of result effective variable in a known process is obvious). In such a situation, applicants must show that the particular range is critical, generally by showing that that claimed range achieves unexpected results. See M.P.E.P. 2144.05 III. In fact, the originally filed specification does not demonstrate any criticality and/or novelty as to why the forming gas has to be four percent.

5. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chung et al. in view of Huang et al. as applied to claim 1 above, and further in view of Yin et al. (US 6,573,175).

Chung et al. in view of Huang et al. substantially teach the claimed method, including removing the resist layer utilizing a plasma etch but do not expressly teach providing a wet preclean after the plasma etching step (d).

However, Yin et al., in an analogous art, teaches providing the ARC layer 18 (SiON); patterning a resist layer 20; etching a first layer 16 (a low-k dielectric) and the ARC layer 18; and removing the resist layer 20 followed by a wet etch to clean undesirable residue 26 (col. 5, lines 30-37) prior to depositing a conductive plug 34 thereon.

Art Unit: 2823

Therefore, it would have been obvious to one of the ordinary skill in the art at the time the invention was made to perform the wet preclean as taught by Yin et al. after removing the resist layer in Chung et al. in view of Huang et al., since by doing so it would clean the residues from the plasma etching, which, in turn, would benefit the critical dimension of the device.

Allowable Subject Matter

6. Claims 13-17 are allowed.
7. The following is a statement of reasons for the indication of allowable subject matter:
The prior art of record, Chung et al. (US 6,184,142), neither teaches nor suggest *removing* the SiON layer.

Response to Arguments

8. Applicant's arguments filed 2/26/04 have been considered but are moot in view of the new ground(s) of rejection.
9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hsien-Ming Lee whose telephone number is 571-272-1863. The examiner can normally be reached on M-F (9:00 ~ 5:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on 571-272-1855.

Art Unit: 2823

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Hsien-Ming Lee
Primary Examiner
Art Unit 2823

May 5, 2004

A handwritten signature in black ink, reading "Hsien-Ming Lee". The signature is written in a cursive style with a large, sweeping "L" at the end.